Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, MAY 19, 1894.

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AN ASTRONOMER HONORED.

The Royal Astronomical Society has sent a gold medal to Mr. S. W. Burnham in recognition of his discovery and measurement of double stars. Upon the presentation of the medal, Captain W. De W. Abney, D.C.L., F.R.S., president of the society, delivered an address, in which he reviewed Mr. Burnham's astronomical work.

Like so many of his *confreres* in astronomical research, Mr. Burnham began as an amateur. He discovered his first 81 pairs of double stars with a 6 inch telescope in Chicago, between 1870 and 1872. He had then no micrometer, and in his first catalogue his distances are not exact measurements, but only estimates. Mr. Burnham has added catalogue after catalogue to his first list of double stars, so that he has published nineteen, containing 1,274 pairs, and another list is now in press.

A remarkable characteristic of Mr. Burnham is that his eye is so acute that he detects a deviation of an infinitesimal quantity from the circular in the disk of a star. Before he began his work, astronomers were not trying to add to the old catalogues of Herschel and the Struves, but his eye saw so much he could not help but make note of these double stars; indeed, he has catalogued a new class, viz., naked-eye stars which have faint companions. Of the whole number he has published, 197 are naked-eye stars not before known to be double.

Since his early discoveries, Mr. Burnham has had the use of the 15½ inch refractor at the Dearborn Observatory at Chicago, and later he had a position in the Lick Observatory, where he has made some of his most valuable observations.

Mr. Burnham has done able critical work in correcting errors, and his contributions to scientific journals have been of a high order.

He now holds the chair of Professor of Practical Astronomy in the Chicago University, and rumor says that he is to be at the head of the Yerkes Observatory when the great 40-inch telescope is in place under its dome.

DANGERS INCIDENT TO ELECTRIC CURRENT DISTRIBUTION.

We have already had occasion to describe the electrolytic corrosion of gas and water mains by the return current of trolley railroad systems. The universal method in vogue with these railroads is to utilize the rails as a part of the return circuit. The car motors are connected in multiple between the trolley wire and rails. An underground return cable connected to all the rails is often used. The motor circuit is completed through the wheels.

When a number of paths are open to the electric current it does not choose the best, but distributes itself proportionately to the resistance among all. Accordingly, the return trolley circuit is not limited to the rails and return cable, but diverges through the soil and utilizes water mains and gas mains and everything that it can get at as part of its path. This establishes potential differences between different portions of the pipes and mains, electrolytic action is produced, and the metal rapidly succumbs.

Several papers on this subject have recently been presented before electrical societies, which show how serious a trouble electrolytic corrosion has become. Samples of corroded pipes were exhibited and various suggestions for overcoming the trouble were suggested or discussed. It has been found that in many cases a current would pass through a wire connecting a couple of pipes, perhaps in a house far removed from the trolley line, and a perceptible spark could be obtained on breaking the circuit. It is said that many residents on the lines of electric roads utilize these currents in their houses, something which, at the least, suggests playing with fire, where an electric potential difference of 500 volts is involved. In one case a gas and a water pipe were found running close together. A neighboring elevator jarred them so frequently that the gas pipe, by mechanical abrasion, perhaps re-enforced by electric action, was nearly worn through. The fact that electric action existed was shown by a spark which formed at every break of contact. In some way the pipes became charged with electricity and at different potentials. It was merely a question of time when the gas main would become completely worn through, the gas would escape, the spark would light it and a conflagration, "cause unknown," would have been the result. Such a disaster might occur in a building that had no electric service within it.

The National Board of Fire Underwriters have become thoroughly awakened to the danger. Their president says that within the past three months there has been plenty of evidence showing that fires caused by electricity are becoming alarmingly frequent. He calls electricity the "greatest present enemy" of the insurance interest. The result of inspections shows that many buildings are imperfectly wired, and that perfect insulation is very rare. When a safe size of wire for a current is given, nothing is more usual than for an amateur to say that he in his experience has got twice the current through the same sized wire. The professional engineer, however, has gone beyond this stage, and uses wires of ample dimensions. But the necessity for absolute insulation in view of recent troubles is very clear, and the possibility of a house without electric service suffering from imperfect street mains is a thing which must be taken into account in future street work. The electrical engineers and inventors have solved the greater problem. They know how to do their work and how to produce results in the direction of distribution of electric energy, but the distribution is at fault in being altogether too wide. The next step must be the retaining the current within the desired circuit. Much remains to be done in this direction.

"THE HARVEST OF A QUIET EYE."

The poets were the earliest observers and they have never abandoned the field. In proportion as they have studied Nature in her varying modes and phases; as they have watched men, the play of their emotions and the development of their motives into action, have they been the interpreters of Nature and of men and have sung songs which linger in the world long after their voices are still.

Tennyson wrote:

> Flower in the crannied wall,
> I pluck you out of the crannies:
> Hold you here, root and all, in my hand,
> Little flower—but if I could understand
> What you are, root and all, and all in all,
> I should know what God and man is.

Thus has the poet shown at once how close together life and its source are and how close is the kinship between the scientist and himself. Both seek for verities, and so far as they find them and hand them over to their fellows are they of use in the world.

Science has done much in breaking down superstition, and in unraveling mysteries, in saying with Scripture, "The truth shall make you free," but it has done more; it has taught men to use their eyes so well as to be slow about basing conclusions upon too few data.

Professor Huxley, in writing of his friend Tyndall, says: "That which he knew, he knew thoroughly, had turned over on all sides, and probed through and through. Whatever subject he took up he never rested till he had attained a clear conception of all the conditions and processes involved or had satisfied himself that it was not attainable. And in dealing with physical problems, I really think that he, in a manner, saw the atoms and molecules and felt their pushes and pulls." And thus do we learn that imagination is no less the servant of the scientist than of the poet.

It would be difficult to find better illustration of the fruit of quiet-eye observation than that shown in the work of Mr. Hamilton Gibson. His remarkable lectures on "Cross-fertilization of Seeds," made doubly clear and interesting by beautiful charts of his own invention, prove that he is as worthy to be named among scientists as among artists.

Time is not too precious, he has thought, for him to spend enough in concealment near a clump of milkweeds to watch the bumble-bees and learn the secret of their relation to that plant. The fertilization of the trumpet creeper had never been satisfactorily explained until Mr. Gibson discovered that it is the work of humming birds. They thrust their long bills down into the nectaries at the base of the blossom, and come out with their backs covered with pollen, which they give to another flower when they seek the same sweets there.

We have all found flies entrapped in corollas and seen birds and bees darting about among the flowers, often too intent to be frightened away by our approach; but not even botanists of fair repute in our century have been close enough lookers to find out that the blossom and the insect have been made for each other—that the perpetuation of species is secured by that drop of sweetness hidden where it cannot be reached by the insect or bird without coming in contact with the pollen.

The old Arabian proverb, "A fig tree looking on a fig tree becometh fruitful," has now an explanation. Pliny and other early writers mentioned the fact that two kinds of fig trees must grow near together if they produce fruit, but they do not account for it.

Close observers in recent times have discovered that the proverb is based not merely upon the existence of staminate and pistillate flowers, but also upon the intervention of an insect which fertilizes them.

Every seed of the fig represents a blossom. The first crop of figs appears in April. These have on them a wasp much like a gall fly; it has four gauzy wings, jet armor and a piercing poniard. When the first pistillate flowers are ripe, crowded together on their receptacle, it creeps down among them and lays an egg in the ovary. A hundred eggs may be laid on one receptacle. The ovaries nourish the embryos of the wasps; they grow there, passing through the grub and pupa states; the males die there, but the female wasps come out and are ready to make a similar attack upon the June crop. These blossoms differ from the early ones in that they have pollen. The wasps,

going into these, cannot get out without becoming covered with pollen, and from them they go to another tree near by which bears true figs, and give to them the pollen; this fertilizes the ovaries, they grow and develop into luscious fruit. There are, therefore, three crops, as it were. The first two are called *capri* figs; the ancients knew them by this name; they sometimes hung branches of the *capri* figs upon the true trees, finding that unless they were brought together in some way, no fruit matured.

The secret of the insects' work has been a modern discovery. Mr. Gibson calls attention to this, one of the most curious examples of cross fertilization, along with those that he has himself made.

The soundness of judgment which the scientist must possess and the gift of expression which the poet has belong to the few, but their methods of observation we may all adopt. And as the resurrection miracle of the spring time is once more going on, there are inviting opportunities. A thrifty robin proved the truth of this a week ago. She was looking about in the grass before my window and had already in her bill what seemed a good load of twine, when she spied a rag which had probably been the tail of a kite. It was narrow, but fully half a yard long. Mrs. Robin evidently considered whether she should leave the twine for this larger prize, but decided to take both. She picked up the rag, dropped it, and took it up again, and again, until she had it so nicely balanced that she could take to her wings. The first flight took her only to a low bough of a tree near by; a little higher she stopped again; the third flight carried her out of sight among the topmost twigs. The precious rag could not have been more useful in the home the robin was building than were the lessons in perseverance and industry which she gave to her unseen observer.

Concrete and Cement Walling.

Cement concrete is now being extensively used for walling and arching purposes with eminently satisfactory results, having regard to its durability in water, earth, or air, and the high resistance it offers to compressive strain. Concrete made of one part by volume of Portland cement and three parts of clean sharp sand is capable of resisting a compressive strain of from 1 to 1½ tons per square inch, while it can with ease be moulded into blocks of any form or dimensions. There is, therefore, no reason why it should not be advantageously used in the lining of shafts, especially where the sand or ballast for the making of the concrete is conveniently procurable. The walling might be built of large blocks of concrete moulded to the radius of the shaft, or of concrete deposited *en masse* behind a properly constructed cylindrical tube, forming, as it were, a guide for the walling. An interesting account of the use of cement in shaft sinking on the Continent is given by Mr. Bennett H. Brough in a paper read before the Federated Institution of Mining Engineers, in which he describes the tubbing of shafts with cement blocks so made and laid as to be perfectly watertight. The blocks are moulded into segments provided on their upper and lower surfaces with grooves and tongues, in much the same manner as match boards, the groove being slightly deeper than the tongue, to enable the joint to be made good with cement. Each block has both its ends grooved out, so that when two blocks are joined together there is in the center of the joint a hollow tubular space, into which cement mortar is tightly rammed, forming, so to speak, a tongue, thus securing and rendering watertight the vertical joint in the same manner as the horizontal joint. In laying one tier of blocks upon another they are so disposed that the vertical joints of one tier are placed over the center of the blocks in the other tier, the intention being to break the joints. The blocks weigh from 1,543 pounds to 1,763 pounds each.

Mr. Brough recounts several instances of the successful application of this process on the Continent, notably the Serlo Colliery, belonging to the Prussian government, at Saarbrucken, where segments of 15·75 inches in thickness and 23·62 inches in height and length were employed, the diameter of the shaft being 9 feet 10 inches. Another instance is that of the salt mines of Leopoldshall, near Starsfurt, where a shaft 500 yards in depth and 17 feet 2½ inches in diameter was tubbed in this manner to exclude the enormous volumes of water met with in the saliferous strata.

In some cases a double ring of cement segments has been employed. According to the particulars given, the cost of the cement lining is considerably cheaper than that of brick lining. The cost of cement tubbing with a single ring of segments is 25*s.* 6*d.* per cubic yard, the estimate including the cost of material and labor for making the blocks, as well as the setting and filling with concrete.

It is estimated that a ring of 13 feet 1½ inches in internal diameter and 13·78 inches in thickness, containing 183·65 cubic feet, costs 7*l.* 7*s.* a yard. To enable a fair comparison of the respective costs of brickwork and cement to be made, it is necessary that the prices of bricks should be stated. Taking the average price of bricks in our own colliery districts in England and Wales at 2*l.* 8*s.* per 1,000, the brickwork, inclusive of all labor and materials, would not exceed 1*l.* 5*s.* per cubic yard, so that there would really be very little difference between the cost of brickwork and cement.

Probably, in Germany, where the above estimate applies to, there is a greater disparity between the prices of materials operating in favor of the adoption of cement. The process, it is stated, has so far proved very satisfactory, and whatever its advantages and disadvantages may be, it is certain that cement concrete is destined to be an important factor in shaft work, as well as in engineering construction generally. —*Engineering.*

Unexplored Arabia.

Mr. and Mrs. Theodore Bent have just returned to England from their scientific expedition in the hitherto almost unknown Hadramaut district of Arabia. In an interview with a representative of Reuter's Agency the explorer gave an interesting account of his experiences. Mr. Bent said:

"Leaving Aden in November last, we proceeded by steamer to Makellah, the nearest point to the Hadramaut Valley, and after journeying for about three weeks, in the course of which we covered some 150 miles, we reached the interior district, our intended goal. The country from the coast to Hadramaut consists of a mountain range and an arid elevated plateau, calling for no special remark. It is practically uninhabited. Contrary to the general belief, the Hadramaut is not a district extending to the coast, but is merely a portion of a big valley in the interior. It is a long valley, in places as much as seven miles wide, but probably its whole extent is about 100 miles. It contains several towns of considerable size, the chief characteristics of which are the magnificent palaces of rulers and the palm groves which produce the splendid dates grown in Arabia. The Hadramaut is inhabited by Arabs and Bedouins, who are divided up into various sections, and are constantly at war with one another. My expedition spent a month in the palace of the Sultan of Shibam, one of the principal towns of the valley. From here we made excursions, often under the Sultan's personal escort, in various directions. The Sultan, who is a member of one of the most powerful and richest families of Arabia, had lived in India for a number of years. I found him to be a very enlightened and well informed man, and one who took a great interest in our work and in the exploration of the ruins in his neighborhood. With regard to the archæological results of the expedition, we came across a number of inscriptions and sites of Sabæan towns. Owing to the kindness of the Sultan, we were able to visit one of the sacred places of the Arabians, which had never before been seen by Europeans. The country has, in fact, only been visited by two Europeans within living memory. Both these travelers were Germans. One visited the country forty years ago, and was driven out by the natives. The other, who penetrated last year, met with great difficulties from the tribes."

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court—Eastern District of Pennsylvania.

L. DURAND, HUGUENIN & CO. *v.* GREEN, SCHULZE-BERGE & KOECHL.

Letters Patent No. 253,721, issued to Horace Koechlin February 14, 1882, for the manufacture of colors or dye-stuffs, construed, and held to claim and to cover a process only.

Judge Dallas, in his decision of this case, gives the following lucid explanation of the principles which must govern the court in construing patent claims:

It was directed by the act of 1836 (sec. 5), that the patent, although annexing the specification of what the applicant claimed as his invention, should "contain a short description or title of the invention or discovery, correctly indicating its nature and design," and should "grant the full and exclusive right to the said invention." It was with express reference to and upon construction of these terms of the act of 1836 that it was decided in Goodyear *v.* R R. Co. that the patentee's monopoly was not, in that case, limited by his claim, but extended to the invention which was described, and the nature and design whereof were correctly indicated in the specification. After the passage of the act of 1836 the profession recognized the convenience and utility of formally stating the claim for which it made provision at the end of the specification, and, from the practice which ensued, as well as for other manifest reasons, the courts were led, as in Goodyear *v.* R. R. Co., to give to such claims much, but not controlling, weight in determining the scope of patent rights.

I now turn to the act of 1870. under which the patent in suit was granted It is, as to the subject under consideration, markedly different from the act of 1836. It mentions the specification and the claim as two distinct things, and requires an inventor, not merely to specify and point out, but to "particularly point out and distinctly claim" his invention. The change in words is very slight; but the difference in meaning i obvious and important. By the one act he was instructed to specify what he alleged to be his invention; by the other he is told that the invention for which he desires a patent he must distinctly claim. The fact that, except as to the change just indicated, the words used in the two acts, when dealing with this matter, are substantially identical is quite convincing that the draughtsman of the act of 1870 actually as well as in presumption of law thus peculiarly varied the language of the act of 1836, not without reason, but with a definite purpose. Nor is the legislative design hard to discern. The practice of the profession and the opinions of the judges, to which I have adverted, had suggested that the embarrassments attendant upon the efforts of the courts to construe vague and indefinite patents might, without doing injustice to patentees, be much alleviated by denying protection for anything, though original, new, and useful, which was not also distinctly claimed.

In brief, it was prescribed that the claim must be taken as defining precisely what the invention covered by the patent is, and hence the true question is not what the patentee might have claimed, but what he has claimed, the latter, not the former, being made the measure of his right. The rules for determining what is claimed in any case are few and simple and are not peculiar to the patent law, except as respects the doctrine of liberality in construction in favor of pioneer inventors. The benefit of that doctrine is claimed by these complainants, and without pausing to examine their title to invoke it, for it cannot avail them, I concede, for the present purpose, its applicability to the achievement of Koechlin. As to the rest, it is sufficient to say that if the language of a claim has a plain and distinct meaning, that meaning must prevail. That which is to be ascertained is, of course, the intent of the claimant, not, however, that intent as elsewhere or in some other manner disclosed, but as expressed in the claim itself. If the meaning of the claim be uncertain—that is to say, if the claim be ambiguous—but still be reasonably capable of elucidation by reference to the specification, the latter may be resorted to for interpretation of the former, but never to change the plain meaning of its language nor to extend it beyond the limits imposed by its own terms, and, *a fortiori*, not so as to create a separate or additional claim.

The National Zoological Park.

The preservation of certain species of American animals, now nearly extinct, was the primary object for which Congress was asked to establish a national zoological park at Washington. The appropriations asked for were very moderate, but in all cases they were cut down. Thus: $36,850 was asked for to erect the necessary buildings; Congress reduced this estimate to $18,000. In this connection it may be noticed that, in Philadelphia, the amount expended for buildings and inclosures was $194,705. The result of this parsimony has been that expedients of a temporary character were adopted, which have proved far from economical. Notwithstanding the inadequacy of the appropriations, the results achieved are highly satisfactory and reflect great credit upon the Smithsonian Institution and its officers. The park, which occupies 40 acres, can be reached by Ontario Avenue. The total number of animals in the park is 448, of which 340 are indigenous to North America. Fifty-five of the animals were obtained by purchase. The animal house, a stone structure, is the principal building. The bear yards are in an abandoned quarry. As Congress has saddled a portion of the expenses both for construction and maintenance upon the District of Columbia, it is little wonder that the new park is largely frequented by residents of the District. Strangers are, however, beginning to visit the park in fair numbers.

Skins of Fruit.

The skins of fruit should never be eaten, not because they are not palatable or digestible or are unhealthy in themselves, but on account of the danger arising from microbes which have penetrated into the covering of the fruit. Everybody has noticed that at times a slight scratch will create a considerable sore on the human body. It is generally ascribed to an unhealthy condition of the blood, but a close microscopical examination will show that it is due to the presence of microbes thus introduced into the system. So with an apple, a peach, a pear, or a grape. The fruit may be perfectly sound and healthy, but on the skin or covering may be microbes, which, introduced into the human system, will breed disease. These germs are not uncommon, neither are they always present. It is possible to eat this covering without injury, but the danger is such that it is best not to incur the risk.—*St. Louis Post-Dispatch.*

A New Southern Comet.

Mr. Gale, of Sydney, discovered a comet in R. A. 37° 42′, Decl. 55° 35′ S., on April 3. This was the second comet of this year, and will therefore be known as comet *b*.